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# SEMICONDUCTOR PACKAGE MODULE STRUCTURE

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[There are no amendments to this patent.]

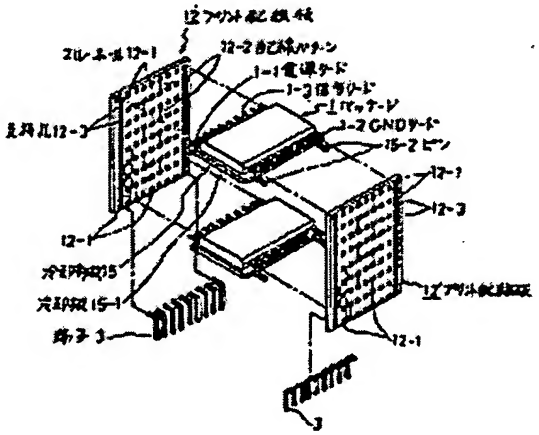
Abstract

Objective

This invention relates to a semiconductor package module structure widely used for circuit construction in all types of electronic equipment. Its objective is to enable cooling of high-density packaged packages as well as make assembly easy.

Constitution

In a semiconductor package module structure comprising semiconductor package (1) where leads (1-1), (1-2) and (1-3) are arranged to project in a planar form on opposite surfaces and printed wiring boards (12) and (12') with a plurality of rows of through holes (12-1) arranged at a fixed pitch, into which each of said leads (1-1), (1-2) and (1-3) of aforementioned semiconductor package (1) are inserted, a plurality of support holes (12-3) is furnished between said rows of through holes (12-1). A cooling member (15) is further furnished on which stands a plurality of pins (15-2) that are inserted into said support holes (12-3) of the aforementioned printed wiring boards (12) and (12') on both side surfaces of cooling plate (15-1), that cools by contacting aforementioned semiconductor package (1), to position said semiconductor package (1).



An oblique view that shows a semiconductor package module structure based on this invention

Key:

| | |
|---|---|
| 1 | Package |
| 1-1 | Power source lead |
| 1-2 | Ground lead |
| 1-3 | Signal lead |
| 3 | Terminal |
| 12 | Printed wiring board |
| 12' | Printed wiring board |
| 12-1 | Through hole |
| 12-2 | Wiring pattern |

12-3 Support hole
15 Cooling member
15-1 Cooling plate
15-2 Pin

Claims

1. A semiconductor package module structure characterized in that, in a semiconductor package module structure comprising semiconductor package (1), where leads (1-1), (1-2) and (1-3) are arranged to project in a planar form on opposite surfaces, and printed wiring boards (12) and (12') with a plurality of rows of through holes (12-1) arranged at a fixed pitch, into which each of said leads (1-1), (1-2) and (1-3) of aforementioned semiconductor package (1) are inserted, a plurality of support holes (12-3) is furnished between said rows of through holes (12-1), and a cooling member (15) is further furnished on which stands a plurality of pins (15-2) that are inserted into said support holes (12-3) of the aforementioned printed wiring boards (12) and (12') on both side surfaces of cooling plate (15-1), that cools by contacting aforementioned semiconductor package (1), to position said semiconductor package (1).

Detailed explanation of the invention

[0001]

Industrial application field

This invention relates to a semiconductor package module structure that is widely used for circuit construction for all types of electronic equipment. Very recently, all types of electronic equipment in particular have been provided with many functions because of progress in miniaturization. Accompanying this, modules with a plurality of various types of semiconductor packages (hereafter abbreviated packages) stacked to be sandwiched by a pair of printed wiring boards are mounted on the printed circuit board units that constitute the circuits.

[0002]

However, problems have arisen, e.g., assembly of packages and printed wiring boards is difficult, and with higher-density packaging, heat generation is greater. So a new semiconductor package module that can solve these problems is required.

[0003]

Prior art

Package module structures widely used in the past, as shown in Figure 5(a), are constituted from packages (1) with power source lead (1-1), ground lead (1-2) and signal leads (1-3) arranged

to project in a planar form at a very small pitch from both side surfaces, a pair of one printed wiring board (2) with soldering through holes (2-1) into which individual leads (1-1), (1-2) and (1-3) are inserted arranged at a pitch approximately equal to the thickness of aforementioned packages (1) such that the bottommost row is used for connecting with terminals (3), such that the through holes (2-1) on the end into which power source leads (1-1) are inserted connect with an inner layer power source layer, not shown, and such that other through holes (2-1) are caused to conduct by surface wiring pattern (2-2), and another printed wiring board (2') with through holes (2-1) on the end into which ground leads (1-2) are inserted connected with an inner layer ground layer and other through holes (2-1) caused to conduct by wiring pattern (2-2), and multiple terminals (3) with fine wires which are of superior conductivity shaped like an L.

[0004]

For assembling these members, first, a terminal (3) is inserted and soldered in each through hole (2-1) (in the row at the bottom) formed in one edge of printed wiring boards (2) and (2') so that each terminal (3) projects in parallel from the bottom surfaces of printed wiring boards (2) and (2'). Then, for example, after a plurality of said packages (1) is stacked by inserting the power source leads (1-1) and signal leads (1-3) of packages (1) into their respective through holes (2-1) furnished in the one printed wiring board (2), the respective through holes (2-1) of the other printed wiring board (2') are fitted with ground leads (1-2) and signal leads (1-3) arranged on the other side of the packages (1).

[0005]

Next, as shown in Figure 5(b), a package module is constructed by soldering each of the through holes (2-1) in the pair of printed wiring boards (2) and (2'), that sandwiches the plurality of packages (1), and leads (1-1), (1-2) and (1-3) of each package (1) projecting through the through holes (2-1).

[0006]

Problems to be solved by the invention

A problem with the conventional module structure explained above is that the module is constructed by repeatedly positioning each of the leads (1-1), (1-2) and (1-3) arranged on both side surfaces of package (1) and the plurality of through holes (2-1) in each row and inserting said leads through the pair of printed wiring boards (2) and (2'), so the problem that occurs is that assembly of packages (1) is difficult for printed wiring boards (2) and (2'). Problems also occur related to cooling, since the entire module will produce a high amount of heat due to the fact that many packages (1) are packaged at high density.

[0007]

Power source lead (1-1) and ground lead (1-2) are also usually disposed at diagonal positions in packages (1). So with a module having a structure where both sides of packages (1) are sandwiched by a pair of printed wiring boards (2) and (2'), since power is supplied to the power source lead (1-1) of packages (1) from the one printed wiring board (2) and the other printed wiring board (2') connects with ground lead (1-2), there is also the problem that maintaining the potential precision of the power source and ground accurately will be difficult.

[0008]

The objective of this invention, in consideration of problems such as described above, is to provide a new semiconductor package module structure that will enable cooling of high-density packaged packages as well as making assembly easy, and that will also make it possible to mount packages in the correct position on the printed wiring board.

[0009]

Means for solving the problems

With this invention, as shown in Figure 1, in a semiconductor package module structure comprising semiconductor packages (1), where leads (1-1), (1-2) and (1-3) are arranged to project in a planar form on opposite surfaces, and printed wiring boards (12) and (12') with a plurality of rows of through holes (12-1), into which each of said leads (1-1), (1-2) and (1-3) of aforementioned semiconductor packages (1) are inserted, arranged at a fixed pitch, a plurality of support holes (12-3) is furnished between said rows of through holes (12-1), and as shown in Figure 2 cooling members (15) are further furnished on each of which stand two pins (15-2) on both side surfaces of cooling plate (15-1), that cools by contacting aforementioned semiconductor package (1), that are inserted into said support holes (12-3) of the aforementioned printed wiring boards (12) and (12') to position said semiconductor package (1).

[0010]

Operation

With this invention, as shown in Figure 4(a), by inserting and affixing a package (1) into the recessed part of cooling plate (15-1) on which stand two pins (15-2) on the two side surfaces, relative positioning of pins (15-2) of the cooling plate (15-1) and each lead (1-1), (1-2) and (1-3) of package (1) is accomplished.

[0011]

Then by inserting the tips of the two pins (15-2) of multiple cooling members (15) to which each of the packages (1) is attached into support holes (12-3) of the printed wiring boards (12) and (12') in sequence and closing the spacing of the printed wiring boards (12) and (12') as shown in Figure 4(b), each lead (1-1), (1-2) and (1-3) of each package (1) is inserted into each through hole (12-1), so module assembly will be easy.

[0012]

A cooling plate (15-1) with outstanding heat conductivity is affixed to the bottom part of each stacked package (1), so it will be possible to improve cooling performance for each package (1).

[0013]

Application example

An application example of this invention will be explained below with Figures 1 through 4. Figure 1 is an oblique view that shows a semiconductor package module structure based on one application example of this invention. Figure 2 is an oblique view that shows the cooling member of this application example. Figure 3 is a partial cross section that shows this application example assembled. Figure 4 is a front view that explains the operation of this invention. In the figures, the same symbols are assigned to the same members as in Figure 5. The additional (12) and (12') are printed wiring boards that sandwich the packages to connect externally, and (15) is a cooling member that supports and cools the package.

[0014]

Printed wiring boards (12) and (12'), as shown in Figure 1, have a plurality of rows of through holes (12-1), into which individual leads (1-1), (1-2) and (1-3) that project from the two side surfaces of packages (1) are inserted and connected, arranged at a somewhat larger pitch than the thickness of an aforementioned package (1). The bottommost row is used for connecting with terminals (3) the same as conventionally. Support holes (12-3) for supporting cooling members (15), discussed below, are placed at the same spacing as through holes (12-1) and formed at both ends of each row between the rows of aforementioned through holes (12-1), and the through holes (12-1) corresponding to the signal leads (1-3) of aforementioned packages (1) also form a pair of printed wiring boards that are connected with surface wiring pattern (12-2).

[0015]

In addition, in the one printed wiring board (12), as shown in Figure 3, all the through holes (12-1) into which power source leads (1-1) of packages (1) are inserted and, for example, an odd number of rows of support holes (12-3) arranged between them are connected with power source layer (12a), and an even number of rows of support holes (12-3) are connected with ground layer (12b). With the other printed wiring board (12'), through holes (12-1), into which ground leads (1-2) are inserted, and an even number of rows of support holes (12-3) are connected with ground layer (12'b) and an odd number of rows of support holes (12-3) are connected with power source layer (12'a) as with the aforementioned printed wiring board (12).

[0016]

With cooling member (15), as shown in Figure 2, a cooling plate (15-1), that is furnished with recessed part (15-1a) of dimensions so that said package (1) can be inserted and positioned, is formed from a metal sheet, for example, copper sheet, with outstanding electrical conductivity in dimensions somewhat larger than the external dimensions of aforementioned package (1), pins (15-2) for inserting into support holes (12-3) of aforementioned printed wiring board (12) stand on both opposing side surfaces with each lead (1-1), (1-2), and (1-3) positioned by recessed part (15-1a) of the cooling plate (15-1), and the entire surface, excluding the bottom surface of aforementioned recessed part (15-1a), is solder plated.

[0017]

With a semiconductor package module structure using the aforementioned member, as shown in Figure 1, a terminal (3) is inserted conventionally into each through hole (12-1) in one row arranged at the edge of printed wiring board (12) and soldered so that each terminal (3) protrudes in parallel from the side surface of printed wiring board (12). The bottom of recessed part (15-1a) of each cooling plate (15-1), shown in Figure 2, of the multiple cooling members (15) is coated with silicone adhesive (16), and the package (1) is integrated with cooling member (15) by being inserted into the recessed part (15-1a).

[0018]

Then power source lead (1-1) of package (1) that is integral with cooling member (15) as shown in Figure 4(a) is pointed toward printed wiring board (12). The tips of the two pins (15-2) that stand on cooling plate (15-1) are inserted in sequence into its support holes (12-3) so that multiple cooling members (15) that have been made integral with packages (1) are easily assembled in printed wiring board (12). Then the tips of the other pins (15-2) of each cooling

member (15) are inserted by the tip [sic] into each support hole (12-3) of printed wiring board (12').

[0019]

In this state, by decreasing the spacing until aforementioned printed wiring boards (12) and (12') contact at both opposite side surfaces of cooling plates (15-1) as shown in Figure 4(b), individual leads (1-1), (1-2) and (1-3) of the stacked packages (1) are inserted into individual through holes (12-1) of printed wiring boards (12) and (12') that sandwich them. Then, as shown in Figure 3, each of said leads (1-1), (1-2) and (1-3), each through hole (12-1), pins (15-2) of cooling member (15), and each of the aforementioned support holes (12-3) are soldered (4) to construct the module.

[0020]

The result is that the tips of the two pins (15-2) standing on each of the two side surfaces of cooling member (15) are inserted into each of the support holes (12-3) of printed wiring boards (12) and (12'). By decreasing the spacing, each lead (1-1), (1-2) and (1-3) of package (1) that is integral with each cooling member (15) is inserted into each of the through holes (12-1), so module assembly will be easy. Each cooling plate (15-1) is also adhered to each of the stacked packages (1), so module cooling performance improves.

[0021]

Power source layers (12a) and (12'a) of printed wiring boards (12) and (12') are also connected by an odd number of stages of cooling members (15). Also, in the odd number stages, ground layers (12b) and (12'b) conduct, so the potential precision of the power source and ground can be accurately maintained.

[0022]

Effect of the invention

As is evident from the explanation above, with this invention, the advantages are that cooling and assembly of packages that are packaged at high density are easy with an extremely simple construction, and the packages can be placed at the correct positions on printed wiring boards. It can provide a semiconductor package module structure with which remarkable economic and reliability improvement effects can be expected.

Brief description of the figures

Figure 1 is an oblique view that shows a semiconductor package module structure based on this invention.

Figure 2 is an oblique view that shows the cooling member of this application example.

Figure 3 is a partial cross section that shows this application example assembled.

Figure 4 is a front view that shows the operation of this invention.

Figure 5 is an oblique view that shows a conventional semiconductor package module structure.

Explanation of symbols

(1) is a package, (1-1) a power source lead, (1-2) a ground lead, (1-3) a signal lead, (3) a terminal, (4) solder, (12) and (12') printed wiring boards, (12a) and (12'a) power source layers, (12b) and (12'b) ground layers, (12-1) a through hole, (12-2) a wiring pattern, (12-3) a support hole, (15) a cooling member, (15-1) a cooling plate, (15-1a) a recessed part, (15-2) a pin, and (16) an adhesive.

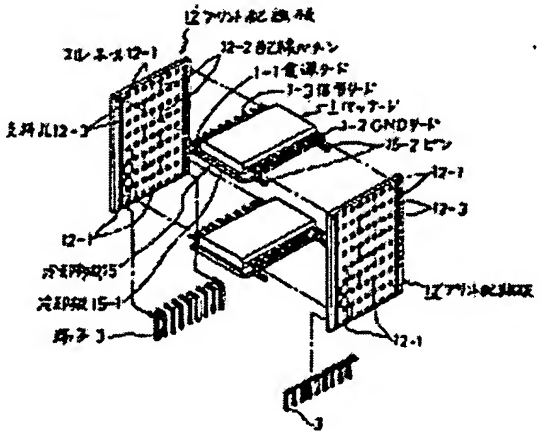


Figure 1. An oblique view that shows a semiconductor package module structure based on this invention

Key:

| | |
|---|---|
| 1 | Package |
| 1-1 | Power source lead |
| 1-2 | Ground lead |
| 1-3 | Signal lead |
| 3 | Terminal |
| 12 | Printed wiring board |
| 12' | Printed wiring board |
| 12-1 | Through hole |
| 12-2 | Wiring pattern |
| 12-3 | Support hole |
| 15 | Cooling member |
| 15-1 | Cooling plate |

15-2 Pin

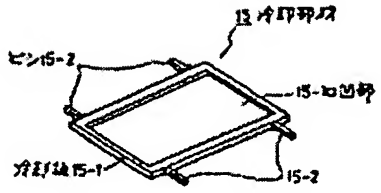


Figure 2. Oblique view that shows the cooling member of this application example

Key: 15 Cooling member
15-1 Cooling plate
15-1a Recessed part
15-2 Pin

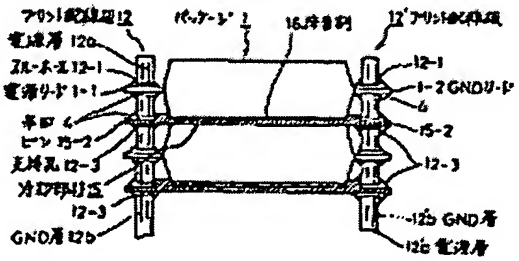


Figure 3. Partial cross section that shows this application example assembled

Key: 1 Package
1-1 Power source lead
1-2 Ground lead
4 Solder
12 Printed wiring board
12' Printed wiring board
12a Power source layer
12b Ground layer
12'a Power source layer
12'b Ground layer
12-1 Through hole
12-3 Support hole
15 Cooling member
15-2 Pin
16 Adhesive

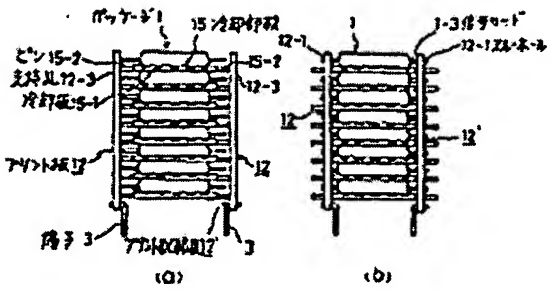


Figure 4. Front view that shows the operation of this invention

Key: 1 Package
1-3 Signal lead
3 Terminal
12 Printed wiring board
12' Printed wiring board
12-1 Through hole
12-3 Support hole
15 Cooling member
15-1 Cooling plate
15-2 Pin

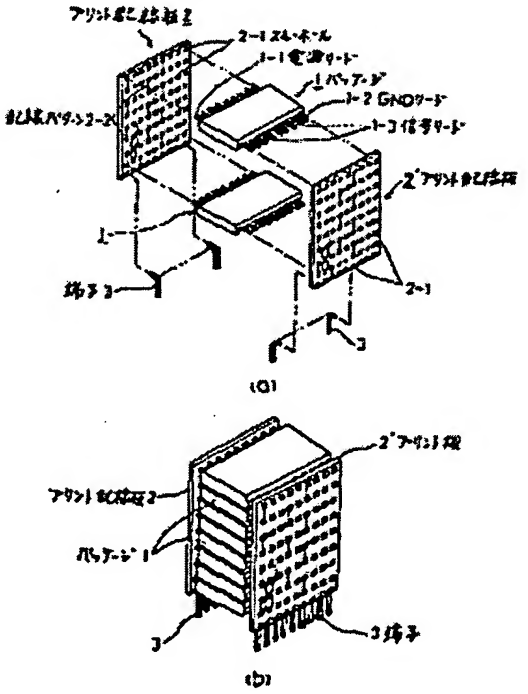


Figure 5. Oblique view that shows a conventional semiconductor package module structure

Key: 1 Package
1-1 Power source lead

| | |
|---|---|
| 1-2 | Ground lead |
| 1-3 | Signal lead |
| 2 | Printed wiring board |
| 2' | Printed wiring board |
| 2-1 | Through hole |
| 2-2 | Wiring pattern |
| 3 | Terminal |